



## **REMARKS**

In the Final Rejection mailed on January 16, previous rejections of the claims and specification have been withdrawn. Claims 1-7, however, have been subjected to a new rejection as obvious under 35 U.S.C. 103(a) as unpatentable over U.S. Patent No. 6,593,267 to Kuo et al. ("Kuo"). These rejections are traversed for the reasons set forth below.

### **Kuo Fails to Disclose or Suggest the Claimed Intercalation**

All pending claims require an intercalated catalyst (or steps of intercalating a catalyst). Kuo fails to disclose such a catalyst. The Final Action suggests, however, that one considering Kuo would be led to the claimed intercalated catalyst. In particular, the Final Action notes that Kuo discloses supported catalysts using some example support materials. The Final Action suggests that, "...given the number of materials that may be used as a support, intercalation would be a conventional means of incorporating the zinc component into the support..." It is respectfully submitted that this is incorrect, and is an oversimplification of the claimed invention. It is further submitted that this stretching of the teachings of Kuo represents an impermissible consideration of Kuo only with the benefit of hindsight gained from consideration of the claimed invention.

Kuo teaches that the carboxylate metal salt can be contacted with the catalyst system, which may be a supported catalyst system such as a supported bulky ligand metallocene catalyst system (see, col. 16, lines 13-16). All the supported catalysts disclosed by Kuo, however, are prepared by conventional means, such as deposited on, contacted with, vaporized with, bonded to, incorporated within, absorbed or absorbed in, or on (see col. 14,

line 55-65), and are achieved through conventional physical steps of combining, contacting, blending, and/or mixing (see col. 15, lines 50-55). These conventional catalyst supports are all physically supported - there is no chemical reaction that takes place during the conventional supporting processes taught by Kuo. Put another way, the support mechanisms disclosed by Kuo are limited to physical interaction.

The present claims, on the other hand, require intercalation by a particular intercalation process. This is significantly different from the conventional teachings of Kuo. Intercalation of a compound into a layered material is a complicated process including both physical interaction and chemical reaction. Kuo fails to disclose or suggest any such structures or steps.

In order to obtain an effective catalyst for the polymerization of carbon dioxide and epoxide, the intercalated catalyst of claims 1-4 requires delaminating inorganic mineral particles having layered structure and intercalating zinc dicarboxylate into an inorganic matrix, and the process of claims 5-7 requires steps of delaminating inorganic mineral particles having layered structure and introducing calcined acidic matrix into the reaction system to perform intercalation. Generally, the delaminating process of the layered support includes a chemical process involving an ion exchanging reaction between the  $H^+$  of diluted acid and the metal cations exiting in the layer gallery of the layered support and a chemical-physical process calcining the layered support after acid treatment. The intercalation of zinc dicarboxylic salt into the gallery of the layered support therefore requires a chemical reaction.

The teachings of Kuo fail to suggest these claimed elements, since Kuo is limited to conventional physical interaction methods. The difference between the claimed invention and the limited teachings of Kuo represent too distant of an inventive leap to be properly reached through an obviousness rejection.

Further, the benefits and advantages achieved by the claimed invention over the teachings of Kuo further confirm that the present claims are not obvious over it. Compared with the conventional supporting techniques and materials taught by Kuo, the active component of the intercalated catalyst of the invention can be better dispersed among the layer of the layered support and on the surface of the support. Conventional supports taught by Kuo will result in the active component of the catalyst only being dispersed on the surface of support. Therefore the claimed intercalated catalyst achieves a significantly enhanced activity over the conventional supported catalyst taught by Kuo, including for the copolymerization of carbon dioxide and epoxide to form poly(alkylene carbonate).

For these reasons, the obviousness rejection of claims 1-7 over Kuo is improper and should be withdrawn.

**Copolymerizing CO<sub>2</sub> and Epoxides Represents More Than an Intended Use**

Each of the present claims require that the intercalated catalyst be for the copolymerization of carbon dioxide and epoxides. The Final Office Action recognizes that Kuo fails to disclose this, but suggests that this represents only an intended use. It is submitted that this is incorrect, and instead that the recitation in the claims calls for functional and structural differences in the claimed material over the disclosure of Kuo.

The catalyst disclosed in Kuo is only capable of polymerizing olefin(s). The polymerization reaction mechanism of olefins is an addition polymerization. The catalyst claimed in the present application, on the other hand, is for the polymerization of epoxides and carbon dioxide. This polymerization mechanism is a ring-opening polymerization. The mechanisms of this polymerization (ring-opening) and that disclosed by Kuo (addition) are significantly different from one another. Catalysts suitable for the two different polymerization mechanisms are likewise significantly different. One skilled in the mechanisms of polymerization of epoxides and carbon dioxide (i.e., the present invention) would not look to the unrelated art of polymerization of olefins (i.e., Kuo) for teachings.

It is well known in the art that different polymerization mechanisms are initiated by different catalysts. The catalyst used for addition-polymerization shows substantially no activity for ring-opening polymerization, and vice versa. The catalysts for the addition-polymerization of olefins as disclosed by the Kuo would have no initiating activity for the ring-opening polymerization of epoxides and carbon dioxide as are required

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by the claimed invention. As a result, there can be no motivation to look to the teachings of Kuo to arrive at the very different claimed invention.

This is another reason that the obviousness rejection of claims 1-7 over Kuo is improper and should be withdrawn.

**New Claims 8-14 are Allowable**

New claims 8-14 have been presented for consideration and are believed to be allowable. These claims are related in scope to claims 5-7, except that they are directed to methods of copolymerizing carbon dioxide and epoxides using an inorganic intercalated catalyst. As noted above, Kuo fails to disclose or suggest these methods. Support for these claims can be found at, among other places, pages 7-8 of the Specification.

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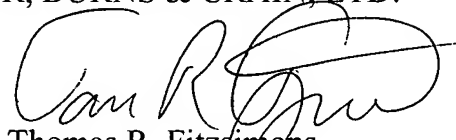
**Conclusion**

Applicants submit that the claims in their present form are patentably distinct over the art of record and are therefore allowable. Allowance of the rejected claims is respectfully requested. Should the Examiner discover there are remaining issues which may be resolved by a telephone interview, he is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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